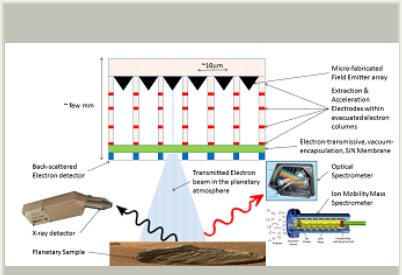
Small Business Innovation Research/Small Business Tech Transfer

Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM), Phase I

Completed Technology Project (2015 - 2016)

Project Introduction

Chromologic (CL) and the California Institute of Technology (Caltech) propose to develop and demonstrate a Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM) instrument that transmits high-energy beams of electrons sequentially from a two-dimensional array of miniaturized electron probes into a planetary atmosphere, and these electrons will strike solid or liquid planetary surfaces to simultaneously generate a wealth of spatially-mapped compositional information. MEDSEM will simultaneously measure X-ray Fluorescence (XRF), Backscattered Electron Spectra, Optical Spectra and Mass Spectra. Caltech will transfer to CL the microfabrication technology for vacuum-encapsulating, electron-transmissive SiN membranes, the key enabling component without which MEDSEM would not be possible. Caltech will also transfer the results of electron-optic simulations performed for optimizing the MEDSEM instrument configuration. The 12-month Phase I effort will be aimed at demonstrating the proof-of-principle for MEDSEM via an experimental setup made up of mostly commercial-off-the-shelf (COTS) parts: miniature electron sources, an x-ray detector and a double-chambered test setup. High-energy electrons will be generated in the first, evacuated chamber, and these electrons will pass through the Caltech-fabricated SiN membrane into the second chamber (maintained at Martian ambient pressure), to strike planetary analog samples thereby generating characteristic XRF. The XRF spectra will be captured by a COTS x-ray detector which is present in the second chamber. Contingent on a successful, follow-on, Phase II effort, the proof-of-principle experiment will be expanded to demonstrate the remaining simultaneous measurement modalities, namely the acquisition of Backscattered Electron Spectra, Optical Spectra and Mass Spectra. Microfabrication of the fully-integrated, field-emitter array of miniaturized electron probes will be pursued during Phase II.



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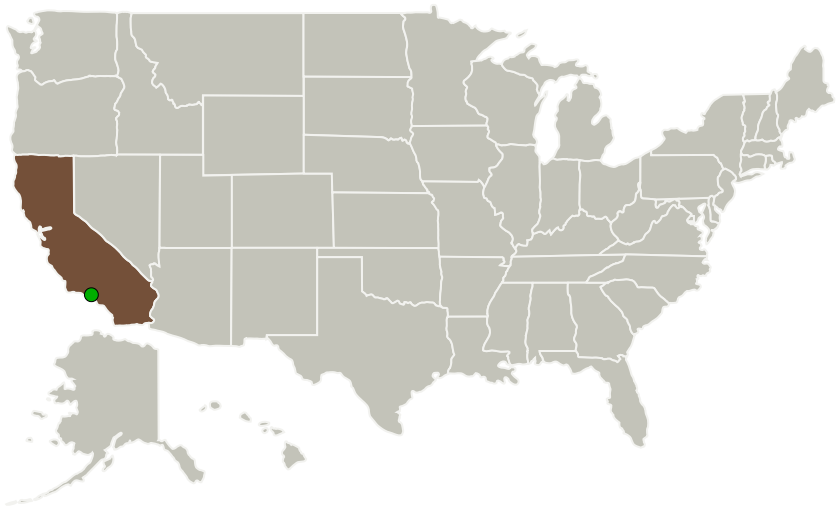
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
ChromoLogic, LLC	Lead Organization	Industry Minority-Owned Business	Monrovia, California
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Project Transitions

June 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ChromoLogic, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Tom George

Co-Investigator:

Tom N George

Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM), Phase I

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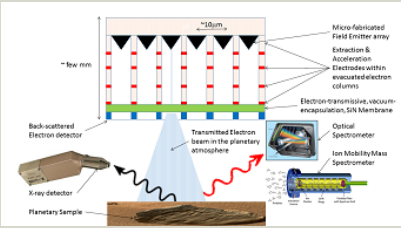
June 2016: Closed out

Closeout Summary: Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM), Phase I Project Image

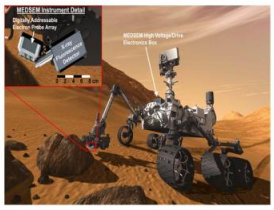
Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139144)*

Images



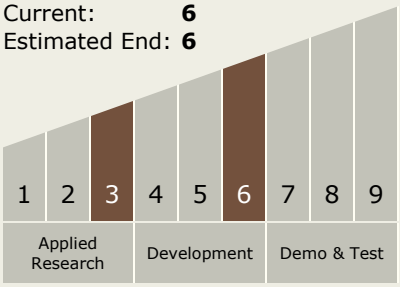
Briefing Chart Image
Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM), Phase I *(https://techport.nasa.gov/image/134426)*



Final Summary Chart Image
Multifunctional Environmental Digital Scanning Electron Microprobe (MEDSEM), Phase I Project Image *(https://techport.nasa.gov/image/133562)*

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System